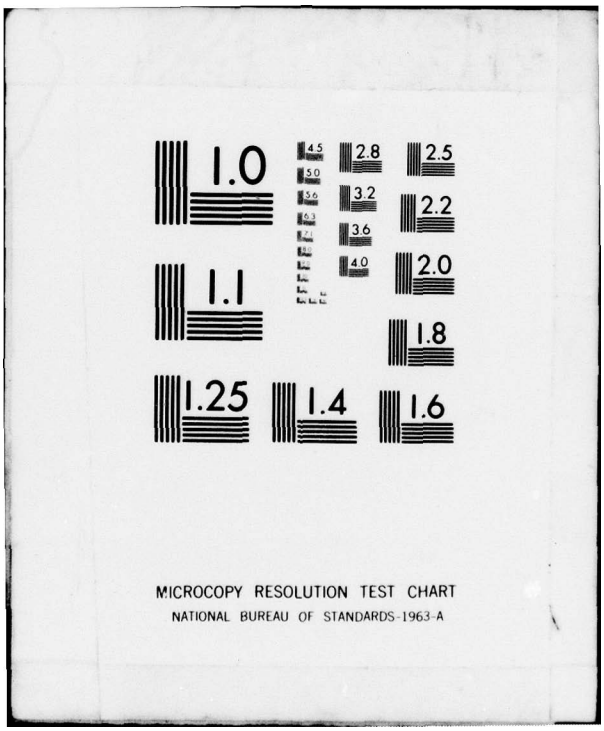
AD-A076 068 DEFENCE AND CIVIL INST OF ENVIRONMENTAL MEDICINE DOW--ETC F/G 5/2
A DOPPLER ULTRASONIC DATA BANK FOR DIVER DECOMPRESSION ANALYSIS--ETC(U)
AUG 79 K E KISMAN , G MASUREL , R GUILLERM

UNCLASSIFIED DCIEM-79-R-28 NL

1 OF 1
AD A076068

END
DATE FILMED
11-79
DDC


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
6.3
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

(3)

(11) AUGUST 1979

DCIEM Report No. 79-R-28

(14) DCIEM-79-R-28

UNLIMITED
DISTRIBUTION
ILLIMITÉE

# (6) A DOPPLER ULTRASONIC DATA BANK FOR DIVER DECOMPRESSION ANALYSIS

(12) 41



(10) K.E. Kisman,
G. Masurel*
R. Guillerm*

Biosciences Division
Defence and Civil Institute of Environmental Medicine
1133 Sheppard Avenue West, P.O. Box 2000
Downsview, Ontario M3M 3B9

* Centre d'Etudes et de Recherches Techniques Sous-Marines
83800 Toulon-Naval
France

DEPARTMENT OF NATIONAL DEFENCE - CANADA

JB

406 986

## TABLE OF CONTENTS

## ABSTRACT

A data bank for Doppler ultrasonic bubble flow data obtained during and following decompression of divers has been established for the purpose of data storage and subsequent computer analysis. Each dive is characterized by 52 parameters selected for future computer correlation studies. For each of 12 of the parameters, a table has been provided into which entries may be made as the data bank grows. Data are entered into the data bank via a specified Data Bank Form. A program entitled DEV is used for listing and verification of data bank files; another entitled SEV is used to calculate an index of severity of decompression. A listing and example are provided for each of the programs, SEV and DEV. The program, SEV, is the first of many possible applications programs utilizing the data bank. The use of the data bank and the application of SEV in an experimental program involving 80 man-dives is described.

## INTRODUCTION

Doppler ultrasonic monitoring of the precordial region of divers has proven to be of considerable benefit for the evaluation of diver decompression stress in subsaturation dives (Lagrue et al, 1978) and saturation dives (Masurel et al, 1978).

In order to better understand the significance of Doppler ultrasonic measurements and the effect of various dive parameters on decompression stress, it is necessary to perform correlation studies of the Doppler results with such parameters as incidence of decompression sickness, decompression models, characteristics of divers, etc. These studies are facilitated by the establishment of a computerized data bank suitable for data storage as well as computer analysis.

This report describes the Doppler Ultrasonic Data Bank (DUDB) established at the Centre d'Etudes et de Recherches Techniques Sous-Marines (CERTSM), France, during the posting of Dr. Kisman from the Defence and Civil Institute of Environmental Medicine (DCIEM), Canada. A joint data base has been established for use by CERTSM and DCIEM personnel to increase the amount of accessible data and to better exploit the inherent possibilities.

## DESCRIPTION OF DATA BANK

It has been customary to monitor ultrasonic data aurally with headphones and assign a grade according to Spencer's classification code (Spencer, 1974). A new code, the KM code, has recently come into use (Kisman et al, 1978a). This code provides more detailed information about the bubble flow; furthermore, it may be evaluated by means of aural monitoring or computer signal analysis. Bubble grades equivalent to those in Spencer's code are provided for the KM code values in a correlation table (Kisman et al, 1978a). Hence precordial Doppler ultrasonic results may be expressed in the form of 3 digit KM code values and/or 1 digit bubble grades.

In addition to the ultrasonic results, the data bank contains many other dive parameters useful for correlation studies. Before these parameters are entered into the data bank, they are written on a Data Bank Form by diving personnel during the decompression (see example, Appendix I).

The following is a description of all parameters in the data bank. They are numbered and ordered as in the Data Bank Form. The classification hierarchy is illustrated in Fig. 1. For each of 12 parameters, a table has been provided in which entries may be added as the data bank grows.

1) File No: The number used to identify the files (see Fig. 1 and Table I). Each diver in each dive is assigned a file number.

2) File Name: The name used by the computer to identify and access the file. It must consist of 5 alphanumeric characters.

3) No of Dive Series: The number designating the collection of related dives which have been grouped together to form a series (see Fig. 1 and Table I).

4) Name of Dive Series: The name of the dive series identified by parameter #3 (used only as aid for reader, not for computer accessing -- see Table I).

5) Profile No: The number designating the dive profile or table followed for the dive identified by parameter #7 (see Table II).

6) Name of Profile: The name describing the dive profile or table identified by parameter #5 (used only as aid for reader -- see Table II). It may contain up to 45 alphanumeric characters.

7) Dive No: The number designating the particular dive (see Fig. 1 and Table I).

8) Name of Dive: The name normally assigned by the diving personnel to describe the dive identified by parameter #7 (used only as aid for reader). It may contain up to 45 alphanumeric characters.

9) Diver No: The number designating the diver (see Table III).

10) Name of Diver: The name of the diver with surname first (used only as aid for reader -- see Table III). It may contain up to 45 letters.

11) Associated DUDB Files: The DUDB file names for other divers who participated in the same dive (i.e., having the same Dive No).

12) Auxilliary Files: Other data files (not DUDB files) containing pertinent, auxilliary information such as pressure and gas composition measured during the dive.

13) Time of Day: The time of day in "hours, min" (e.g., "18, 36") corresponding to time zero of the dive timer.

14) Date of Dive: Has the form "day, month, year" (e.g., "4, 1, 78" or "24, 10, 77").

15) Weight: The diver's weight in kilograms (kg).

16) Height: The diver's height in meters (m).

17) Fat Comp: The fat composition of the diver. The scale has yet to be established.

18) Type of Dive: The type of dive may be classified according to existing or new entries in Table IV.

19) Environment: The environment of the dive may be classified according to existing or new entries in Table V.

20) Temperature: The temperature experienced by the diver (in $^{\circ}$C).

21) Type of Work: The nature of the work performed by the diver may be identified according to existing or new entries in Table VI.

22) Quantity of Work: The quantity of work performed by the diver at the bottom depth (in kwatt-hours).

23) Tape Recorder: The number of the tape recorder used to tape the ultrasonic data (see Table VII).

24) Tape No: The number designating the tape on which the ultrasonic data is recorded (see Table VIII).

25) Depth Code: The code designating the units used for all depth measurements (see Table IX).

26) Bottom Depth: The depth at bottom of the dive.

27) Time Code: The code designating the format used to express time in all cases (see Table X).

28) Time Prof Alt: The time from the dive timer at which the profile designated by Profile No. was altered due to decompression sickness, excessive bubbles, etc.

29) T(Beg): The time from the dive timer indicating when the dive started. It is normally set equal to zero.

30) T(Arrival): The time from the dive timer indicating arrival at bottom of dive.

31) T(Beg Decomp): The time from the dive timer indicating the beginning of the decompression.

32) T(End Decomp): The time from the dive timer indicating the end of the decompression.

33) Comments: Special comments about the dive may be entered here.

34) Monitor Nos: The numbers designating the monitors who acquisitioned the ultrasonic data and evaluated the code values or bubble grades in the list of results on the second page of the Data Bank Form. The order of the monitor numbers is the same as used in the list of results.

35) Total No of Evaluations: The number of evaluations in the following list of results multiplied by the number of monitors.

36) Eval No: The number of the evaluation performed by a monitor for a particular section of data. When all of the evaluations made by one monitor are listed, the Eval No. is reset to 1 for the results of the next monitor.

37) D(R): The bubble grade or code value assigned by the monitor for the section of data corresponding to the diver at rest. If no assignment was made because of bad data, 999 is entered.

38) D(M): This is the same as D(R) but is used for the section of data corresponding to the diver performing a specified movement.

39) Time: The time from the dive timer at which the ultrasonic monitoring of the diver was performed.

40) Depth: The depth at which the ultrasonic monitoring of the diver was performed.

41) Tape Rest: The number on the counter of the tape recorder at which occurs the beginning of the data for the diver at rest.

42) Tape Move: The numbers on the counter of the tape recorder at which begins the data following diver movement (for up to three movements).

43) WD(R): A whole between 0 and 4 (maximum weight) which is determined by the monitor as the weight to be assigned to the result D(R) based on the quality of the signal on the recording.

44) WD(M): This is the same as WD(R) but applies to the result D(M).

45) No of Incidences of D.S.: The number of times the diver experiences decompression sickness. If no report is available as to whether or not D.S. occurred, this number is set at "-1".

46) D.S. No: The number, starting at "1", designating in order of appearance the incidence of decompression sickness.

47) Type: The type of decompression sickness as listed in Table XII.

48) Severity: A number describing the severity of the sickness. The scale is yet to be determined but it must consist of integer numbers (e.g., 0 to 10).

49) T(Start): The time from the dive timer indicating the start of the decompression sickness.

50) P(Start): The depth of the commencement of the decompression sickness.

51) T(End): The time according to the dive timer of the end of the decompression sickness.

52) P(End): The depth of the end of the decompression sickness.

This data bank does not contain the actual pressure versus time and gas composition measurements that may be obtained in other data banks such as CANDID (Kuehn and Sweeney, 1973) in use at DCIEM. However, the profile or dive table used to control the dive is identified in DUDB by a number and a name.

There are currently 80 DUDB files in the data bank. These files, which have names D0001 to D0080, constitute the dive series "Doris France - Amer Profile Comparison" (Lagrue et al, 1978).

## PROCEDURE

A) During the dive, the diving personnel fill out the Data Bank Form in a manner similar to that shown in Appendix I. Where necessary, the bubble grades or code values may be evaluated (from the recording of the ultrasonic data) and entered in the Data Bank Form following the dive.

The Data Bank Form shown in Appendix I contains, as an example, the data entered for the first file, D0001, in DUDB. The data format required is indicated on the Form. The rules for entering the data are as follows:

a) Integers are indicated by the letter "I". For example, "3I3" means that three integer numbers (separated by commas) containing a maximum of 3 characters each may be used. For the PDP-11/10 computer the maximum value is 32767 for an integer number.

b) Real numbers are indicated by the letter F. For example, "F7.2" means that a real number must be used (i.e., containing a decimal point), that the maximum number of characters including the decimal point is 7, and that at most two characters after the decimal point may be used.

c) The letter "A" indicates that numbers, letters or symbols may be used in free format. For example, "5A1" means that five characters may be entered.

d) For items 11 and 12 on the Data Bank Form, only one character can be entered in each space provided. The file names are separated by a space or a comma.

e) If there is no data available for a given parameter, one enters 0 for a parameter of the form "I", 0. for a parameter of the form "F", and blank spaces for a parameter of the form "A".

f) After the data has been entered for the first monitor in items 36 to 44, it is not necessary to repeat the information in items 39 to 42 for subsequent monitors.

g) When necessary, appropriate additions may be made to Tables I to XII.

B) Following the dive, the data from the Data Bank Form are entered into a computer via a teletype and stored on computer media such as floppy disks or magnetic tapes. The data from one Data Bank Form constitute one DUDB file.

Currently, the data are entered via a teletype into a DEC PDP-11/10 computer and stored on floppy disks in a DEC RX-01 floppy disk system. The operating software used is DEC RT-11 and the EDIT program provided with this software is used for the creation of the DUDB files. Approximately 240 DUDB files can be stored on one floppy disk.

The rules for entering the data into a DUDB file are as follows:

a) The data are entered line by line using the data type indicated on the Data Bank Form and separating each item on a line with commas. For the first five lines on the Data Bank Form, the second item must be entered on a separate line. Items 11 and 12 may be separated by either a blank or a comma.

b) The EDIT program in the DEC RT-11 operating software allows one to enter an integer number without regard to location within the field allocated even if it is not followed by a comma. For example, the number "4" to be entered for parameter #35 may be typed in the first space on the line without a following comma.

   Two commas together ",," mean 0 for a parameter of type I or 0. for a parameter of type F. If following an item on a line the rest of the items are 0 or 0. the rest of the line may be left blank.

c) Bubble grades with "+" or "-" symbols are entered according to the following table:

| Bubble grade | 0 | 1- | 1 | 1+ | 2- | 2 | 2+ | 3- | 3 | 3+ | 4- | 4 | 4+ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data entered | 0 | 10 | 1 | 11 | 20 | 2 | 21 | 30 | 3 | 31 | 40 | 4 | 41 |

C) The contents of the new DUDB file may be verified by running the program DEV which is described below. With DEV, one may list a single DUDB file or a series of files one after the other. To list a series of DUDB files, another type of file, a "file file" is created using, once again, the EDIT program. The file file consists of

   a) an integer number, on the first line, which indicates the number of DUDB file names in the file file.

   b) the DUDB file names (one per line) up to a maximum of 100 lines.

D) The DUDB files may be used in application programs such as SEV (which is described below) to calculate the index of severity or perform correlation studies.

## PROGRAM DEV

The computer program for data evaluation, DEV, is used to list and verify the data in the DUDB files. It is written in Fortran to be compatible with scientific applications programs (see below) for which Fortran is commonly used.

An example showing how DEV may be used is provided in Appendix II. In Part a), the data are shown exactly as they were typed in on the teletype from the Data Bank Form to create DUDB File D0001 using the EDIT program.

Then the program, DEV, is run as shown in Part b) of Appendix II. The instructions for running the program are:

a) The computer requests "Number of file files?". This is the number of file files which are described in Part C of PROCEDURE. For example, one may wish to use one file file named FF1 containing DUDB Files D0001 to D0100 and a second file file named FF2 containing DUDB Files D0101 to D0140.

   In this example, one would type "2↓" where "↓" means teletype carriage "return". If only a single DUDB file is required, no entry is made (one types "↓").

b) If an entry is made to the first question, the second question is "FILE FILE". In the above example, one types "FF1↓".

c) If no entry is made to the first question, the second question is "DIVE FILE:". As an example, one may type "D0001↓" to list DUDB File D0001.

Finally, in Part c of Appendix II, there is a complete listing of the program DEV.

## PROGRAM SEV

An applications program, SEV (S evaluation), has been written in Fortran to evaluate the index of severity of decompression, S (Kisman et al, 1978), using the ultrasonic data stored in a DUDB file.

The general expression for the index of severity is

$$S_\gamma(\alpha,f) = \frac{1}{(0.02)(4^\alpha)(t_j - t_o)} \sum_{i=1}^{j} \{(d^\alpha_{\gamma,i} + d^\alpha_{\gamma,i-1})(t_i - t_{i-1}) f(p_i, p_{i-1})\}$$

where the index i represents the measurement number for the measurements of bubble grade, $d_{\gamma,i}$ (i = 0 indicates the beginning of decompression, i = j indicates the final measurement),

$d_{\gamma,i}$ is the bubble grade measured (for $\gamma$ = r, the diver is at rest during the measurement, for $\gamma$ = m the diver performs a specified movement),

$t_i$ is the time at which measurement number i was made, and

$p_i$ is the depth at which measurement number i was made.

This equation represents the integration over time of the bubble grades d (having exponent $\alpha$ as an experimentally determined parameter). The denominator is a normalization factor. The factor, $f(p_i,p_{i-1})$, takes into account the fact that the significance of the bubble grades may be functions of the depth at which they are measured. Experimental evidence (Kisman et al, 1978) indicates that the factor f may be set equal to 1 for air dives so that $S_\gamma(\alpha,f) \equiv S_\gamma(\alpha)$.

As an illustration of the use of SEV for computing the index of severity, $S_\gamma(\alpha)$, an example of its use and a complete listing of SEV have been provided in Appendix III. In Para a) of Appendix III, SEV is run using the DUDB File D0001. The computer output is in the form of $S(R,\alpha)$ or $S(M,\alpha)$ where $\gamma$ = R defines the situation where the diver is at rest and $\gamma$ = M indicates that the diver has performed a specified movement. A complete set of results for which the parameter $\alpha$ varies between 1 and 7 is provided for each monitor. Instructions for the use of SEV are as follows:

a) In response to the first question, "type 1 for data listing:", one types "1↓" to obtain a data listing in a format identical to that obtained with the program, DEV. One types " " if no data listing is desired.

b) The second number required is the time code as defined in Table X which designates the format used for the second number, the time range. The time range is the maximum time after the beginning of decompression within which the ultrasonic data in the DUDB file are used to calculate S.

c) The subsequent questions are identical to those posed in DEV.

The DUDB data bank and the program, SEV, were used in an experimental program to compare bounce dive tables of the Ministère Francais du Travail with corresponding American surface decompression tables having the same bottom depth and time at bottom (Lagrue et al, 1978). Seventy-two man-dives for 18 French and 18 corresponding American profiles were performed and the data were entered into 72 files of the DUDB data bank. The ultrasonic data for one diver, DA, diving to 33 m for 40 min are shown in Fig. 2 for the French profile A and the American profile B. All of the bubble grade measurements made during and following the decompression were used by the program SEV to compute the index of severity $S_v(3)$. Statistical comparisons of $S_r(3)$ were made for the two series of profiles. The general result of this study is that there is no statistically significant difference in decompression stress in the two series even though the American profile briefly produces a high pressure gradient in the tissues of the divers at the beginning of the decompression. Hence, because surface decompression is safer operationally, the American series is the preferred one.

## CONCLUSIONS

A Doppler ultrasonic data bank has been established. All of the parameters included in the data bank have been fully described and for each of twelve parameters, a table has been provided in which entries may be added as the data bank grows. The procedure for entry of data (including a copy of the Data Bank Form used), the verification of, and use of the data have been outlined. The program, DEV, which is used for listing and verification of DUDB files has been listed and an example of its use provided. The program, SEV, which is used to calculate the index of severity of decompression has been listed and an example of its use provided. The program, SEV, is the first of many possible applications programs which will make use of the information stored in DUDB files. The DUDB data bank and the program, SEV, were employed to compute the index of severity, S(R,3), in order to compare a series of French and corresponding American dive profiles in an experimental program involving 72 man-dives.

## REFERENCES

KISMAN K.E., G. MASUREL, R. GUILLERM. Bubble evaluation code for Doppler ultrasonic decompression data. Undersea Biomedical Research 5, No. 1 (supplement) 28 (Abstract) (1978a). A brochure available from author.

KISMAN K.E., G. MASUREL, D. LAGRUE, J.C. LE PECHON. Evaluation de la qualité d'une décompression basée sur la détection ultrasonore de bulles. Médecine Aéronautique et Spatiale, Médecine Subaquatique et Hyperbare 17, No. 67, 293-297 (1978b).

KUEHN L.A., D.M.C. SWEENEY. Canadian Diving Data: A Computerized Decompression Data Bank. Computers and Biomedical Research 6, 266(1973).

LAGRUE D., J.C. LE PECHON, G. MASUREL, K. KISMAN, R. GUILLERM. Etude comparative de la méthode de décompression du ministère français du travail et de décompression dite de surface de l'US Navy pour la plongée à l'air. Médecine Aéronautique et Spatiale, Médecine Subaquatique et Hyperbare (à paraître) 1978.

MASUREL G., E. GRAS, B. GARDETTE, A. TERNISIEN, R. GUILLERM. Détection ultrasonore par effet Doppler de bulles circulantes au cours de plongées humaines d'intervention Hélium-Oxygène. Médecine Aéronautique et Spatiale, Médecine Subaquatique et Hyperbare 16, No. 62, 131 (1977).

SPENCER M.P. Decompression limits for compressed air determined by ultrasonically detected blood bubbles. J. Appl. Physiol. 40, 229 (1976).

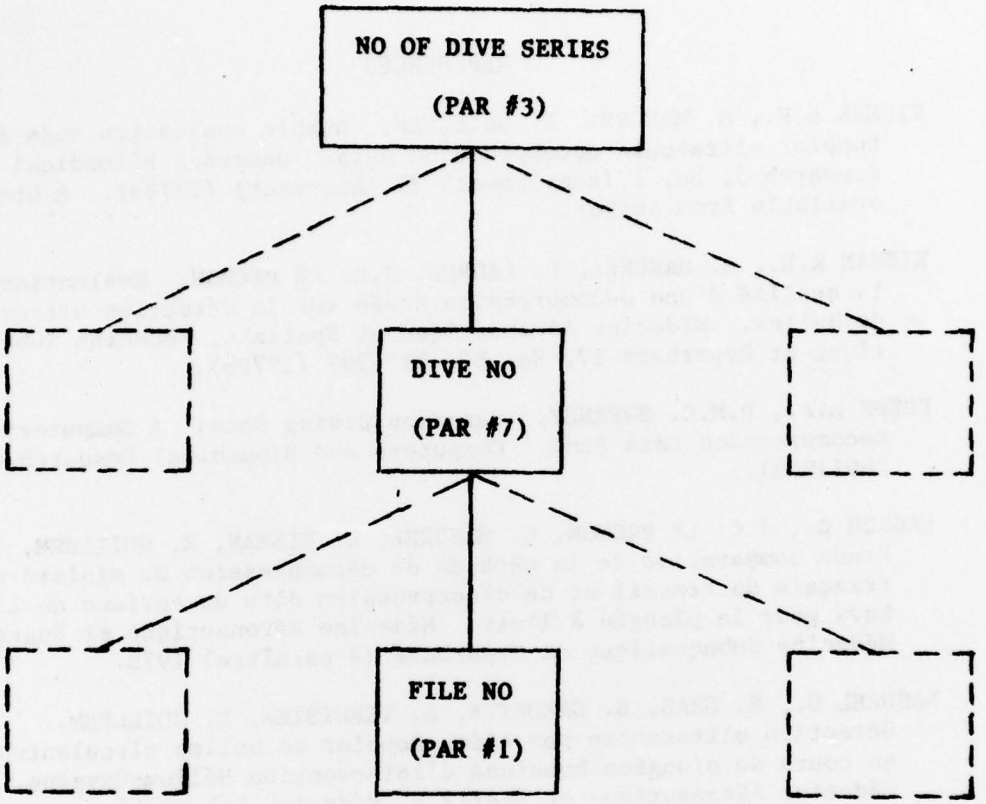



Figure 1: Classification hierarchy of DUDB dive parameters. Each dive series (identified by parameter #3) may involve a number of dives (identified by parameter #7) each of which involves one or more divers. Each man-dive is identified by a file no. (parameter #1).

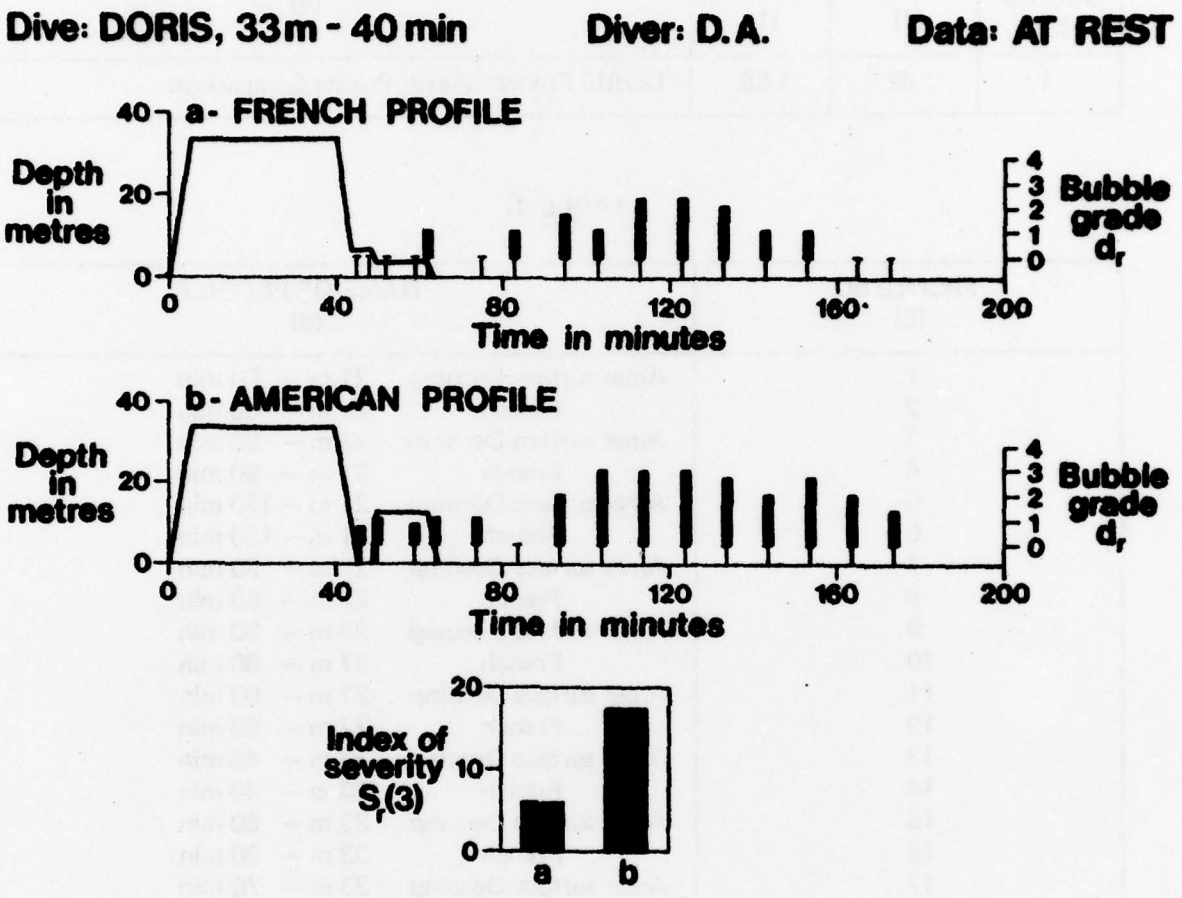



Figure 2: An example of the use of the index of severity of decompression $S_\gamma(\alpha)$ calculated by the program SEV using ultrasonic bubble grade data to compare a French profile (of the Ministère du Travail) with an American profile (involving surface decompression).

TABLE I

| NO OF DIVE SERIES (3) | DIVE NOS (7) | FILE NOS (1) | NAME OF DIVE SERIES (4) |
|---|---|---|---|
| 1 | 1-42 | 1-80 | DORIS France - Amer Profile Comparison |

TABLE II

| PROFILE NO (5) | NAME OF PROFILE (6) |
|---|---|
| 1 | Amer surface Decomp 21 m – 50 min |
| 2 | French 21 m – 50 min |
| 3 | Amer surface Decomp 21 m – 90 min |
| 4 | French 21 m – 90 min |
| 5 | Amer surface Decomp 21 m – 120 min |
| 6 | French 21 m – 120 min |
| 7 | Amer surface Decomp 27 m – 60 min |
| 8 | French 27 m – 60 min |
| 9 | Amer surface Decomp 27 m – 80 min |
| 10 | French 27 m – 80 min |
| 11 | Amer surface Decomp 27 m – 90 min |
| 12 | French 27 m – 90 min |
| 13 | Amer surface Decomp 33 m – 40 min |
| 14 | French 33 m – 40 min |
| 15 | Amer surface Decomp 33 m – 60 min |
| 16 | French 33 m – 60 min |
| 17 | Amer surface Decomp 33 m – 70 min |
| 18 | French 33 m – 70 min |
| 19 | Amer surface Decomp 39 m – 30 min |
| 20 | French 39 m – 30 min |
| 21 | Amer surface Decomp 39 m – 40 min |
| 22 | French 39 m – 40 min |
| 23 | Amer surface Decomp 39 m – 60 min |
| 24 | French 39 m – 60 min |
| 25 | Amer surface Decomp 45 m – 25 min |
| 26 | French 45 m – 25 min |
| 27 | Amer surface Decomp 45 m – 40 min |
| 28 | French 45 m – 40 min |
| 29 | Amer surface Decomp 45 m – 50 min |
| 30 | French 45 m – 50 min |
| 31 | Amer surface Decomp 51 m – 20 min |
| 32 | French 51 m – 20 min |
| 33 | Amer surface Decomp 51 m – 30 min |
| 34 | French 51 m – 30 min |
| 35 | Amer surface Decomp 51 m – 40 min |
| 36 | French 51 m – 40 min |

**TABLE III**

| DIVER NO (9) | NAME OF DIVER (10) |
|---|---|
| 1 | DAUMAS, B. |
| 2 | PERON, M. |
| 3 | ADALBERT, P. |
| 4 | CHEVALLIER, Y. |
| 5 | CADOUX, F. |
| 6 | SCHMALTZ, J.C. |
| 7 | FOURCADE, M. |
| 8 | DAVID, B. |
| 9 | SERNANDE, E. |
| 10 | LEFEVRE, P. |
| 11 | FAURAT, A. |
| 12 | GEANT, C. |
| 13 | MERIOT, P. |
| 14 | BARON, L. |
| 15 | MICHAULT, C. |
| 16 | BEARD, P. |
| 17 | BUSNEL, J.F. |
| 18 | CANNAVACCINOLO, J. |
| 19 | TARNEE, O. |
| 20 | PRIETO, J.J. |
| 21 | MARTINEZ, R. |

**TABLE IV**

| NO | TYPE OF DIVE (18) |
|---|---|
| 1 | Air |
| 2 | Helium – Oxygen |
| 3 | Helium – Nitrogen – Oxygen |

**TABLE V**

| NO | ENVIRONMENT (19) |
|---|---|
| 1 | Chamber – Dry |
| 2 | Chamber – Wet |
| 3 | Open sea |
| 4 | Body of Fresh Water |

**TABLE VI**

| NO | TYPE OF WORK (21) |
|---|---|
| 1 | CYCLING |

**TABLE VII**

| TAPE RECORDER NO (23) | TAPE RECORDER | |
|---|---|---|
| | MODEL | SERIAL NO |
| 1 | PHILIPS N4419 | |

## TABLE VIII

| TAPE NO (24) | TAPE | |
|---|---|---|
| 1 | DORIS | B1B |
| 2 | | B3A |
| 3 | | A3A |
| 4 | | B3B |
| 5 | | A3B |
| 6 | | B5A |
| 7 | | A5A |
| 8 | | B4B |
| 9 | | B2B |
| 10 | | B4A |
| 11 | | B2A |
| 12 | | B8B |
| 13 | | A8B |
| 14 | | B6A |
| 15 | | A6A |
| 16 | | B6B |
| 17 | | A6B |
| 18 | | B8A |
| 19 | | A8A |
| 20 | | A16A |
| 21 | | B14A |
| 22 | | B14A |
| 23 | | A16B |
| 24 | | B14B |
| 25 | | A14A |
| 26 | | B16A |
| 27 | | A14B |
| 28 | | A17A |
| 29 | | B17A |
| 30 | | A18A |
| 31 | | B18A |
| 32 | | A18B |
| 33 | | B18B |
| 34 | | A20A |
| 35 | | B20A |
| 36 | | A21A |
| 37 | | B21A |
| 38 | | A19A |
| 39 | | B19A |
| 40 | | A21B |
| 41 | | B21B |
| 42 | | A19B |
| 43 | | B19B |
| 44 | | A19A |
| 45 | | B20B |
| 46 | | A15A |
| 47 | | B15A |
| 48 | | A15B |

## TABLE VIII

| TAPE NO (24) | TAPE | |
|---|---|---|
| 49 | DORIS | B15B |
| 50 | | A17B |
| 51 | | B17B |
| 52 | | A22A |
| 53 | | A22A |
| 54 | | A21B |
| 55 | | B22B |
| 56 | | A1B |
| 57 | | A7A |
| 58 | | B7A |
| 59 | | A13A |
| 60 | | B13A |
| 61 | | A13B |
| 62 | | B13B |
| 63 | | A10A |
| 64 | | B10A |
| 65 | | B10B |
| 66 | | A10B |
| 67 | | A12A |
| 68 | | B12A |
| 69 | | A12B |
| 70 | | B12B |
| 71 | | A11B |
| 72 | | B11B |
| 73 | | A11A |
| 74 | | B11A |
| 75 | | A9B |
| 76 | | B9B |
| 77 | | A9A |
| 78 | | B9A |
| 79 | | B7B |
| 80 | | A7B |

## TABLE IX

| NO | DEPTH CODE (25) |
|---|---|
| 1 | msw |
| 2 | fsw |
| 3 | mfw |
| 4 | ffw |
| 5 | ATA |
| 6 | ATG |

## TABLE X

<table>
<tr><th>NO</th><th>TIME CODE (27)</th></tr>
<tr><td>1</td><td>Days-Hours-Min-Sec<br>Examples :
<table>
<tr><th>Days</th><th>Hours</th><th>Min</th><th>Sec</th><th>Code</th></tr>
<tr><td>4</td><td>3</td><td>25</td><td>15</td><td>40325.15</td></tr>
<tr><td></td><td></td><td>30</td><td></td><td>30.00</td></tr>
<tr><td></td><td>23</td><td>0</td><td>5</td><td>2300.05</td></tr>
</table></td></tr>
<tr><td>2</td><td>Hours-Min-Sec<br>Examples :
<table>
<tr><th>Hours</th><th>Min</th><th>Sec</th><th>Code</th></tr>
<tr><td>146</td><td>32</td><td>5</td><td>14632.05</td></tr>
<tr><td></td><td>5</td><td></td><td>5.00</td></tr>
</table></td></tr>
<tr><td>3</td><td>Min-Sec<br>Examples :
<table>
<tr><th>Min</th><th>Sec</th><th>Code</th></tr>
<tr><td>244</td><td>30</td><td>244.30</td></tr>
<tr><td>5</td><td></td><td>5.</td></tr>
</table></td></tr>
</table>

## TABLE XI

| MONITOR NO (34) | NAME OF MONITORS |
|---|---|
| 1 | KISMAN, K. |
| 2 | MASUREL, G. |
| 3 | DORIS |
| 4 | KISMAN + MASUREL (CERTSM) |
| 5 | GRAS |
| 6 | FRANCOISE |
| 7 | J. PAUL |
| 8 | DIDIER |

**TABLE XII**

| NO | TYPE OF DECOMPRESSION SICKNESS (47) |
|---|---|
| 1 | Bends |
| 2 | Bend – Knee |
| 3 | Bend – Elbow |
| 4 | Bend – Shoulder |
| 5 | Bend – Hip |
| 6 | Bend – Vestibular |
| 7 | Articular Pain |

# DATA BANK FORM

| (1) FILE NO (I5): | 1 | (2) FILE NAME (5A1): | D0001 |
|---|---|---|---|

| (3) NO OF DIVE SERIES (I6): | (4) NAME OF DIVE SERIES (45A1): |
|---|---|
| 1 | DORIS FRANCO-AMER PROFILE COMPARISON |

| (5) PROFILE NO (I6): | (6) NAME OF PROFILE (45A1): |
|---|---|
| 14 | FRENCH 33m - 40 min. |

| (7) DIVE NO (I6): | (8) NAME OF DIVE (45A1): |
|---|---|
| 1 | FRENCH NO. 10 BIB |

| (9) DIVER NO (I6): | (10) NAME OF DIVER (45A1): |
|---|---|
| 1 | DAUMAS B. |

(11) ASSOCIATED DUDB FILES (7(5A1,1X)):

D 0 0 5 6

(12) AUXILIARY FILES (4(5A1,1X))

| (13) TIME OF DAY (F7.2): | 0. | (14) DATE OF DIVE (3I3): | 23.8.77 |
|---|---|---|---|
| (15) WEIGHT (F6.2): | 0. | (16) HEIGHT (F6.2): | 0. |
| (17) FAT COMP (F6.2): | 0. | (18) TYPE OF DIVE (I4): | 1 |
| (19) ENVIRONMENT (I4): | 1 | (20) TEMPERATURE (F6.1): | 0. |
| (21) TYPE OF WORK (I4): | 0 | (22) QUANTITY OF WORK (F6.1): | 0. |
| (23) TAPE RECORDER (I6): | 1 | (24) TAPE NO (I6): | 1 |
| (25) DEPTH CODE (I4): | 1 | (26) BOTTOM DEPTH (F6.1): | 33. |
| (27) TIME CODE (I4): | 3 | (28) TIME PROF ALT (F10.2): | 0. |

| (29) T(BEG) (F10.2) | (30) T(ARRIVAL) (F10.2) | (31) T(BEG DECOMP) (F10.2) | (32) T(END DECOMP) (F10.2) |
|---|---|---|---|
| 0. | 5. | 40.3 | 63. |

(33) COMMENTS (71A1)

(34) MONITOR NOS (4I5):

| | 3 | | |
|---|---|---|---|

AUG 1978

| (35) TOTAL No. OF EVALUATIONS (16) : | 32 |
|---|---|

| (36) EVAL No (I4) | (37) D(R) (I4) | (38) D(M) (I4) | (39) TIME (F9.2) | (40) DEPTH (F9.2) | (41) TAPE REST (I5) | TAPE (42) MOVE A (I5) | B (I5) | C (I5) | (43) WD(R) (F6.2) | (44) WD(M) (F6.2) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 45. | 3. | 7. | 15 | | | | |
| 2 | 0 | 0 | 48. | 3. | 24 | | | | | |
| 3 | 0 | 0 | 52. | 3. | 42 | 47 | | | | |
| 4 | 0 | 0 | 59. | 3. | 56 | 63 | | | | |
| 5 | 0 | 0 | 62. | 0 | 71 | 76 | | | | |
| 6 | 112 | 112 | 75. | 0 | 85 | 93 | | | | |
| 7 | 112 | 112 | 83. | 0 | 100 | 108 | | | | |
| 8 | 112 | 112 | 95. | 0 | 118 | 127 | | | | |
| 9 | 112 | 0 | 103. | 0 | 142 | 150 | | | | |
| 10 | 232 | 343 | 113. | 0 | 160 | 168 | | | | |
| 11 | 232 | 232 | 123. | 0 | 180 | 189 | | | | |
| 12 | 0 | 0 | 133. | 0 | 204 | 215 | | | | |
| 13 | 112 | 112 | 143. | 0 | 228 | 241 | | | | |
| 14 | 0 | 212 | 153. | 0 | 255 | 268 | | | | |
| 15 | 112 | 112 | 165. | 0 | 279 | 297 | | | | |
| 16 | 0 | 0 | 173. | 0 | 316 | 331 | | | | |
| 1 | 0 | 0 | | | | | | | | |
| 2 | 0 | 0 | | | | | | | | |
| 3 | 0 | 0 | | | | | | | | |
| 4 | 0 | 0 | | | | | | | | |
| 5 | 1 | 0 | | | | | | | | |
| 6 | 0 | 0 | | | | | | | | |
| 7 | 1 | 1 | | | | | | | | |
| 8 | 20 | 1 | | | | | | | | |
| 9 | 1 | 1 | | | | | | | | |
| 10 | 21 | 3 | | | | | | | | |
| 11 | 21 | 3 | | | | | | | | |
| 12 | 2 | 2 | | | | | | | | |
| 13 | 999 | 1 | | | | | | | | |
| 14 | 999 | 2 | | | | | | | | |
| 15 | 0 | 2 | | | | | | | | |
| 16 | 0 | 1 | | | | | | | | |

| (36) EVAL No (I4) | (37) D(R) (I4) | (38) D(M) (I4) | (39) TIME (F9.2) | (40) DEPTH (F9.2) | (41) TAPE REST (I5) | (42) TAPE MOVE A (I5) | B (I5) | C (I5) | (43) WD(R) (F6.2) | (44) WD(M) (F6.2) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

(45) No OF INCIDENCES OF D.S.(I6) : 0

| (46) DS. No (I4) | (47) TYPE (I4) | (48) severity (I4) | (49) T( START) (F10.2) | (50) P(START) (F10.2) | (51) T(END) (F10.2) | (52) P(END) (F10.2) |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

## APPENDIX II

(a)

```
.R EDIT
*EWDX1:D0001.PARS$
*I1
D0001
1
DORIS FRANCO-AMER PROFILE COMPARISON
14
FRENCH 33 M - 40 MIN
1
FRENCH NO. 10 BIB
1
DAUMAS B.
D0056

0.,23,8,77
0.,0.
0.,1
1,0.
0,0.
1,1
1,33.
3,0.
0.,5.,40.3,63.

1,3,0,0
32
1,0,0,45.,3.,7,15
2,0,0,48.,3.,24
3,0,0,52.,3.,42,47
4,0,0,59.,3.,56,63
5,0,0,62.,0.,71,76
6,112,112,75.,0.,85,93
7,112,112,83.,0.,100,108
8,112,112,95.,0.,118,127
9,112,0,103.,0.,142,150
10,232,343,113.,0.,160,168
11,232,332,123.,0.,180,189
12,0,0,133.,0.,204,215
13,112,112,143.,0.,228,241
14,0,212,153.,0.,255,268
15,112,112,165.,0.,279,297
16,0,0,173.,0.,316,331
1,0,0
2,0,0
3,0,0
4,0,0
5,1,0
6,0,0
7,1,1
8,20,1
9,1,1
10,21,3
11,21,3
12,2,2
13,999,1
14,999,2
15,0,2
16,0,1
0
$$
*EX$$
```

(b)

```
•RUN DX1:DEV

NUMBER OF FILE FILES ?

**********************************

DIVE FILE : D0001

**********************************

FILE:.......  #     1,  D0001

DIVE SERIES:  #     1,  DORIS FRANCO-AMER PROFILE COMPARISON

PROFILE:....  #    14,  FRENCH 33 M - 40 MIN

DIVE:.......  #     1,  FRENCH NO. 10 B1B

DIVER:......  #     1,  DAUMAS B.

ASSOCIATED DUDB FILES:  D0056
AUXILLIARY FILES:

TIME OF DAY:.....   0.00      DATE OF DIVE:....  23  8 77
WEIGHT:..........   0.00      HEIGHT:..........      0.00
FAT COMPOSITION:.   0.00      TYPE OF DIVE:....         1
ENVIRONMENT:.....      1      TEMPERATURE:.....       0.0
TYPE OF WORK:....      0      QUANTITY OF WORK:       0.0
TAPE RECORDER NO:      1      TAPE NO:.........         1
DEPTH CODE:......      1      BOTTOM DEPTH:....      33.0
TIME CODE:.......      3      TIME OF PROF ALT:      0.00

T(BEG):.......     0.00
T(ARRIVAL):...     5.00
T(BEG DECOMP):    40.30
T(END DECOMP):    63.00

MONITOR NOS:      1      3      0      0

TOTAL NO OF EVAL:    32

EVAL  D(R), D(M),   TIME,   DEPTH, TAPE: REST, TAPE: MOVE, WD(R), WD(M)
 NO                                          A   B     C
  1     0     0     45.00     3.0      7     15    0     0  0.00   0.00
  2     0     0     48.00     3.0     24      0    0     0  0.00   0.00
  3     0     0     52.00     3.0     42     47    0     0  0.00   0.00
  4     0     0     59.00     3.0     56     63    0     0  0.00   0.00
  5     0     0     62.00     0.0     71     76    0     0  0.00   0.00
  6   112   112     75.00     0.0     85     93    0     0  0.00   0.00
```

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 7 | 112 | 112 | 83.00 | 0.0 | 100 | 108 | 0 | 0 | 0.00 | 0.00 |
| 8 | 112 | 112 | 95.00 | 0.0 | 118 | 127 | 0 | 0 | 0.00 | 0.00 |
| 9 | 112 | 0 | 103.00 | 0.0 | 142 | 150 | 0 | 0 | 0.00 | 0.00 |
| 10 | 232 | 343 | 113.00 | 0.0 | 160 | 168 | 0 | 0 | 0.00 | 0.00 |
| 11 | 232 | 332 | 123.00 | 0.0 | 180 | 189 | 0 | 0 | 0.00 | 0.00 |
| 12 | 0 | 0 | 133.00 | 0.0 | 204 | 215 | 0 | 0 | 0.00 | 0.00 |
| 13 | 112 | 112 | 143.00 | 0.0 | 228 | 241 | 0 | 0 | 0.00 | 0.00 |
| 14 | 0 | 212 | 153.00 | 0.0 | 255 | 268 | 0 | 0 | 0.00 | 0.00 |
| 15 | 112 | 112 | 165.00 | 0.0 | 279 | 297 | 0 | 0 | 0.00 | 0.00 |
| 16 | 0 | 0 | 173.00 | 0.0 | 316 | 331 | 0 | 0 | 0.00 | 0.00 |
| 1 | 0 | 0 | 0.00 | 0.0 | 0 | 0 | 0 | 0 | 0.00 | 0.00 |
| 2 | 0 | 0 | 0.00 | 0.0 | 0 | 0 | 0 | 0 | 0.00 | 0.00 |
| 3 | 0 | 0 | 0.00 | 0.0 | 0 | 0 | 0 | 0 | 0.00 | 0.00 |
| 4 | 0 | 0 | 0.00 | 0.0 | 0 | 0 | 0 | 0 | 0.00 | 0.00 |
| 5 | 1 | 0 | 0.00 | 0.0 | 0 | 0 | 0 | 0 | 0.00 | 0.00 |
| 6 | 0 | 0 | 0.00 | 0.0 | 0 | 0 | 0 | 0 | 0.00 | 0.00 |
| 7 | 1 | 1 | 0.00 | 0.0 | 0 | 0 | 0 | 0 | 0.00 | 0.00 |
| 8 | 20 | 1 | 0.00 | 0.0 | 0 | 0 | 0 | 0 | 0.00 | 0.00 |
| 9 | 1 | 1 | 0.00 | 0.0 | 0 | 0 | 0 | 0 | 0.00 | 0.00 |
| 10 | 21 | 3 | 0.00 | 0.0 | 0 | 0 | 0 | 0 | 0.00 | 0.00 |
| 11 | 21 | 3 | 0.00 | 0.0 | 0 | 0 | 0 | 0 | 0.00 | 0.00 |
| 12 | 2 | 2 | 0.00 | 0.0 | 0 | 0 | 0 | 0 | 0.00 | 0.00 |
| 13 | 999 | 1 | 0.00 | 0.0 | 0 | 0 | 0 | 0 | 0.00 | 0.00 |
| 14 | 999 | 2 | 0.00 | 0.0 | 0 | 0 | 0 | 0 | 0.00 | 0.00 |
| 15 | 0 | 2 | 0.00 | 0.0 | 0 | 0 | 0 | 0 | 0.00 | 0.00 |
| 16 | 0 | 1 | 0.00 | 0.0 | 0 | 0 | 0 | 0 | 0.00 | 0.00 |

NO OF INCIDENCES OF D.S.: 0

```
 R FORTRAN
*DX1:DEV,TT:=DX1:DEV/L:1/W
RT-11 FORTRAN IV          V01B-08     MON 28-AUG-78 00:12:58        PAGE 001

0001          LOGICAL*1 BUFLAG(80),FILNAM(14),EXT(4),CC(45),EE(45),FF1(5)
0002          LOGICAL*1 FF2(5),FF3(5),FF4(5),FF6(5),FF7(5),GG1(5)
0003          LOGICAL*1 GG2(5),GG3(5),GG4(5),II(45),EEE(71),NFILN(100,5)
0004          LOGICAL*1 TN(5),TNX(5),AAA(5),FN(45)
0005          INTEGER*2 IN(3),IFF(4),I1(200),I2(200),I3(200),I6(200)
0006          INTEGER*2 I7(200),I8(200),I9(200),I20(10),I21(10),I22(10)
0007          INTEGER*2 MCH(50)
0008          REAL*4 F4(200),F5(200),F10(200),F11(200),F23(10),F24(10)
0009          REAL*4 F25(10),F26(10)
0010          DATA FILNAM/'D','X','1',':',10*' ',/,EXT/'.','P','A','R'/
0011          DATA TNX/5*' '/
        C
0012          NN = 0
0013       80 TYPE 210
0014          ACCEPT 211, NON
0015          IF (NON.EQ.0) GO TO 1
0017       87 NN = NN+1
0018          TYPE 217
0019          TYPE 213
0020       84 ACCEPT 101,NCH,(BUFLAG(I),I=1,NCH)
0021          TYPE 217
0022          IF (NCH.EQ.0.OR.NCH.GT.6) GO TO 84
0024          DO 81 I=1,NCH
0025       81 FILNAM(I+4) = BUFLAG(I)
0026          DO 82 I=1,4
0027       82 FILNAM(I+NCH+4) = EXT(I)
0028          CALL ASSIGN(2,FILNAM,NCH+8,'OLD')
0029          READ (2,211) KEND
0030          DO 83 IPK=1,KEND
0031       83 READ (2,101) MCH(IPK),(NFILN(IPK,IPL), IPL=1,MCH(IPK))
0032          CALL CLOSE (2)
0033          DO 90 N=1,KEND
0034          DO 91 INA=1,6
0035       91 TN(INA) = TNX(INA)
0036          DO 85 IY=1,MCH(N)
0037          TN(IY) = NFILN(N,IY)
0038       85 FILNAM(IY+4) = NFILN(N,IY)
0039          DO 86 IZ=1,4
0040       86 FILNAM(IZ+MCH(N)+4) = EXT(IZ)
0041          TYPE 216
0042          TYPE 214
0043          TYPE 215, TN
0044          TYPE 214
0045          CALL ASSIGN (2,FILNAM,MCH(N)+8,'OLD')
0046          GO TO 88
0047        1 TYPE 214
0048          TYPE 100
0049          ACCEPT 101, NCH,(BUFLAG(I), I=1,NCH)
0050          TYPE 214
0051          IF(NCH.EQ.0.OR.NCH.GT.6) GO TO 1
0053          DO 2 I = 1,NCH
0054        2 FILNAM(I+4) = BUFLAG(I)
0055          DO 3 I = 1,4
0056        3 FILNAM(I+NCH+4) = EXT(I)
0057          CALL ASSIGN (2,FILNAM,NCH+8,'OLD')
0058       88 CONTINUE
        C
```

```
0059          READ (2,300) IAAA,AAA
0060          READ (2,301) IB,CC
0061          READ (2,301) IFN,FN
0062          READ (2,301) ID,EE
0063          READ (2,301) IH,II
0064          READ (2,302) FF1,FF2,FF3,FF4,FF5,FF6,FF7
0065          READ (2,303) GG1,GG2,GG3,GG4
0066          READ (2,304) FX,IN
0067          READ (2,305) FJ,FK
0068          READ (2,306) FL,IM
0069          READ (2,307) IO,FP
0070          READ (2,307) IQ,FR
0071          READ (2,308) IS,IT
0072          READ (2,307) IU,FV
0073          READ (2,309) IW,PPP
0074          READ (2,310) FAA,FBB,FCC,FDD
0075          READ (2,311) EEE
0076          READ (2,312) IFF
0077          READ (2,313) IGG
0078          READ (2,115) (I1(I),I2(I),I3(I),F4(I),F5(I),I6(I),I7(I),
             1I8(I),I9(I),F10(I),F11(I), I=1,IGG)
0079          READ (2,313) IHH
0080          IF (IHH.EQ.0) GO TO 14
0082          READ (2,116) (I20(J),I21(J),I22(J),F23(J),F24(J),F25(J),
             1F26(J), J=1,IHH)
      C
0083    14    CONTINUE
      C
0084          CALL CLOSE (2)
      C
0085          TYPE 400,IAAA,AAA
0086          TYPE 401,IB,CC
0087          TYPE 402,IFN,FN
0088          TYPE 403,ID,EE
0089          TYPE 404,IH,II
0090          TYPE 405,FF1,FF2,FF3,FF4,FF5,FF6,FF7
0091          TYPE 406,GG1,GG2,GG3,GG4
0092          TYPE 407,FX,IN
0093          TYPE 408,FJ,FK
0094          TYPE 409,FL,IM
0095          TYPE 410,IO,FP
0096          TYPE 411,IQ,FR
0097          TYPE 412,IS,IT
0098          TYPE 413,IU,FV
0099          TYPE 414,IW,PPP
0100          TYPE 415,FAA,FBB,FCC,FDD
0101          TYPE 416,EEE
0102          TYPE 417,IFF
0103          TYPE 418,IGG
0104          TYPE 125
0105          TYPE 126, (I1(I),I2(I),I3(I),F4(I),F5(I),I6(I),I7(I),I8(I),
             1I9(I),F10(I),F11(I), I=1,IGG)
0106          TYPE 129, IHH
0107          IF(IHH) 11,11,10
0108    10    TYPE 127
0109          TYPE 128, (I20(J),I21(J),I22(J),F23(J),F24(J),F25(J),
             1F26(J), J=1,IHH)
```

```
      C
0110  11    CONTINUE
0111  90    CONTINUE
0112        IF (NN.LT.NON) GO TO 87
0114        TYPE 216
      C
0115   100  FORMAT(/'$DIVE FILE : ')
0116   101  FORMAT(Q,80A1)
0117   115  FORMAT(3I4,2F9.2,4I5,2F6.2)
0118   116  FORMAT(3I4,4F10.2)
0119   125  FORMAT(' EVAL','  D(R), D(M),   TIME,   DEPTH, TAPE: REST,',
     1' TAPE: MOVE, WD(R), WD(M)',/'  NO',44X,'A   B    C',/)
0120   126  FORMAT(1X,I3,3X,I3,3X,I3,F11.2,F8.1,2I7,2I5,2F6.2,/)
0121   127  FORMAT(//' D.S. NO, TYPE, SEVERITY, T(START),   P(START),',
     1'   T(END),   P(END)',/)
0122   128  FORMAT(I5,I7,I9,2F12.2,2F11.2,/)
0123   129  FORMAT(' NO OF INCIDENCES OF D.S.:',I6,/)
0124   210  FORMAT (/'$NUMBER OF FILE FILES ? ')
0125   211  FORMAT (I4)
0126   213  FORMAT (//'$FILE FILE : ')
0127   214  FORMAT (/'**********************************')
0128   215  FORMAT (/' DIVE FILE : ',6A1)
0129   216  FORMAT (/////////)
0130   217  FORMAT (//'!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!')
0131   300  FORMAT(I5,/,5A1)
0132   301  FORMAT(I6,/,45A1)
0133   302  FORMAT(7(5A1,1X))
0134   303  FORMAT(4(5A1,1X))
0135   304  FORMAT(F7.2,3I3)
0136   305  FORMAT(2F6.2)
0137   306  FORMAT(F6.2,I4)
0138   307  FORMAT(I4,F6.1)
0139   308  FORMAT(2I6)
0140   309  FORMAT(I4,F10.2)
0141   310  FORMAT(4F10.2)
0142   311  FORMAT(71A1)
0143   312  FORMAT(4I6)
0144   313  FORMAT(I6)
0145   400  FORMAT(/' FILE:.....  ','#',I6,',  ',5A1/)
0146   401  FORMAT(' DIVE SERIES: ',1X,'#',I6,',  ',45A1,/)
0147   402  FORMAT(' PROFILE:....  ','#',I6,',  ',45A1,/)
0148   403  FORMAT(' DIVE:.....  ','#',I6,',  ',45A1,/)
0149   404  FORMAT(' DIVER:.....  ','#',I6,',  ',45A1,/)
0150   405  FORMAT(' ASSOCIATED DUDB FILES: ',7(1X,5A1))
0151   406  FORMAT(' AUXILLIARY FILES: ',5X,4(1X,5A1)/)
0152   407  FORMAT(' TIME OF DAY:.....',F7.2,5X,
     1'DATE OF DIVE:.... ',3(1X,I2))
0153   408  FORMAT(' WEIGHT:..... ',F6.2,5X,
     1'HEIGHT:.....    ',F6.2)
0154   409  FORMAT(' FAT COMPOSITION:. ',F6.2,5X,
     1'TYPE OF DIVE:....',6X,I4)
0155   410  FORMAT(' ENVIRONMENT:.....   ',I4,5X,
     1'TEMPERATURE:.....',4X,F6.1)
0156   411  FORMAT(' TYPE OF WORK:....   ',I4,5X,
     1'QUANTITY OF WORK:',4X,F6.1)
0157   412  FORMAT(' TAPE RECORDER NO: ',I6,5X,
     1'TAPE NO:.....',4X,I6)
```

```
RT-11 FORTRAN IV          V01B-08     MON 28-AUG-78 00:12:58          PAGE 004

0158    413  FORMAT(' DEPTH CODE:.....    ',I4,5X,
              1'BOTTOM DEPTH:....',4X,F6.1)
0159    414  FORMAT(' TIME CODE:.......    ',I4,5X,
              1'TIME OF PROF ALT:',F10.2,/)
0160    415  FORMAT(' T(BEG):.......',F10.2,/' T(ARRIVAL):...',F10.2,
              1/' T(BEG DECOMP):',F10.2/' T(END DECOMP):',F10.2,/)
0161    416  FORMAT(1X,71A1,/)
0162    417  FORMAT(' MONITOR NOS:',4(1X,I6),/)
0163    418  FORMAT(' TOTAL NO OF EVAL:',I6,/)
0164         END
*
```

## APPENDIX III

(a)

```
.RUN DX1:SEV

TYPE 1 FOR DATA LISTING :

TYPE CODE, TIME RANGE : 3,136,1

NUMBER OF FILE FILES ?

**********************************

DIVE FILE : D0001

**********************************

                MONITOR NO.    1

S(R,1) =  21.29                 S(M,1) =  23.55
S(R,2) =   9.52                 S(M,2) =  12.39
S(R,3) =   5.17                 S(M,3) =   8.28
S(R,4) =   3.16                 S(M,4) =   6.21
S(R,5) =   2.03                 S(M,5) =   4.87
S(R,6) =   1.34                 S(M,6) =   3.88
S(R,7) =   0.89                 S(M,7) =   3.12

                MONITOR NO.    3

S(R,1) =  24.97                 S(M,1) =  31.13
S(R,2) =  11.68                 S(M,2) =  16.37
S(R,3) =   5.84                 S(M,3) =   9.80
S(R,4) =   3.05                 S(M,4) =   6.36
S(R,5) =   1.63                 S(M,5) =   4.34
S(R,6) =   0.89                 S(M,6) =   3.06
S(R,7) =   0.49                 S(M,7) =   2.20
```

(b)

32

```
.R FORTRAN
*DX1:SEV,TT:=DX1:SEV/L:1/W
RT-11 FORTRAN IV          V01B-08     MON 28-AUG-78 01:17:38        PAGE 001

0001          LOGICAL*1 BUFLAG(80),FILNAM(14),EXT(4),CC(45),EE(45),FF1(5)
0002          LOGICAL*1 FF2(5),FF3(5),FF4(5),FF5(5),FF6(5),FF7(5),GG1(5)
0003          LOGICAL*1 GG2(5),GG3(5),GG4(5),II(45),EEE(71),NFILN(100,5)
0004          LOGICAL*1 TN(5),TNX(5),AAA(5),FN(45)
0005          INTEGER*2 IN(3),IX(2),IFF(4),I1(200),I2(200),I3(200),I6(200)
0006          INTEGER*2 I7(200),I8(200),I9(200),I20(10),I21(10),I22(10)
0007          INTEGER*2 ASSD(64),ASSC(64),RES(13),MCH(50)
0008          REAL*4 F4(200),F5(200),F10(200),F11(200),F23(10),F24(10)
0009          REAL*4 F25(10),F26(10),F4S(200),F23S(10),F25S(10),DEG(13)
0010          REAL*8 SR(7),SM(7)
0011          DATA FILNAM/'D','X','1',':',10*' '/,EXT/'.','P','A','R'/
0012          DATA ASSD/10,1,1,11,11,2,2,2,2,2,30,30,2,30,3,3,
             110,1,20,20,20,2,21,21,2,30,3,3,30,3,3,31,
             21,20,2,2,2,21,30,3,30,3,3,31,3,31,31,40,
             320,2,21,30,30,3,3,3,3,31,40,4,31,4,4,41/
0013          DATA ASSC/111,112,113,114,121,122,123,124,131,132,133,134,
             1141,142,143,144,211,212,213,214,221,222,223,224,231,232,
             2233,234,241,242,243,244,311,312,313,314,321,322,323,324,
             3331,332,333,334,341,342,343,344,411,412,413,414,421,422,
             4423,424,431,432,433,434,441,442,443,444/
0014          DATA DEG/0.,0.6666667,1.,1.3333333,1.6666667,2.,
             12.3333333,2.6666667,3.,3.3333333,3.6666667,4.,4./
0015          DATA RES/0,10,1,11,20,2,21,30,3,31,40,4,41/
0016          DATA TNX/5*' '/
      C
0017          TYPE 200
0018          ACCEPT 201,IDATA
0019          TYPE 202
0020          ACCEPT 203, ICOD,TJ
0021          NN = 0
0022      80  TYPE 210
0023          ACCEPT 211, NON
0024          IF (NON.EQ.0) GO TO 1
0026      87  NN = NN+1
0027          TYPE 217
0028          TYPE 213
0029      84  ACCEPT 101,NCH,(BUFLAG(I),I=1,NCH)
0030          TYPE 217
0031          IF (NCH.EQ.0.OR.NCH.GT.6) GO TO 84
0033          DO 81 I=1,NCH
0034      81  FILNAM(I+4) = BUFLAG(I)
0035          DO 82 I=1,4
0036      82  FILNAM(I+NCH+4) = EXT(I)
0037          CALL ASSIGN(2,FILNAM,NCH+8,'OLD')
0038          READ (2,211) KEND
0039          DO 83 IPK=1,KEND
0040      83  READ (2,101) MCH(IPK),(NFILN(IPK,IPL), IPL=1,MCH(IPK))
0041          CALL CLOSE (2)
0042          DO 90 N=1,KEND
0043          DO 91 INA=1,6
0044      91  TN(INA) = TNX(INA)
0045          DO 85 IY=1,MCH(N)
0046          TN(IY) = NFILN(N,IY)
0047      85  FILNAM(IY+4) = NFILN(N,IY)
0048          DO 86 IZ=1,4
0049      86  FILNAM(IZ+MCH(N)+4) = EXT(IZ)
0050          TYPE 216
```

```
0051          TYPE 214
0052          TYPE 215, TN
0053          TYPE 214
0054          CALL ASSIGN (2,FILNAM,MCH(N)+8,'OLD')
0055          GO TO 88
0056     1    TYPE 214
0057          TYPE 100
0058          ACCEPT 101, NCH,(BUFLAG(I), I=1,NCH)
0059          TYPE 214
0060          IF(NCH.EQ.0.OR.NCH.GT.6) GO TO 1
0062          DO 2 I = 1,NCH
0063     2    FILNAM(I+4) = BUFLAG(I)
0064          DO 3 I = 1,4
0065     3    FILNAM(I+NCH+4) = EXT(I)
0066          CALL ASSIGN (2,FILNAM,NCH+8,'OLD')
      C
0067    88    CONTINUE
0068          READ (2,300) IAAA,AAA
0069          READ (2,301) IB,CC
0070          READ (2,301) IFN,FN
0071          READ (2,301) ID,EE
0072          READ (2,301) IH,II
0073          READ (2,302) FF1,FF2,FF3,FF4,FF5,FF6,FF7
0074          READ (2,303) GG1,GG2,GG3,GG4
0075          READ (2,304) FX,IN
0076          READ (2,305) FJ,FK
0077          READ (2,306) FL,IM
0078          READ (2,307) IO,FP
0079          READ (2,307) IQ,FR
0080          READ (2,308) IS,IT
0081          READ (2,307) IU,FV
0082          READ (2,309) IW,PPP
0083          READ (2,310) FAA,FBB,FCC,FDD
0084          READ (2,311) EEE
0085          READ (2,312) IFF
0086          READ (2,313) IGG
0087          READ (2,115) (I1(I),I2(I),I3(I),F4(I),F5(I),I6(I),I7(I),
             1I8(I),I9(I),F10(I),F11(I), I=1,IGG)
0088          READ (2,313) IHH
0089          IF(IHH.EQ.0) GO TO 14
0091          READ (2,116) (I20(J),I21(J),I22(J),F23(J),F24(J),F25(J),
             1F26(J), J=1,IHH)
0092    14    CONTINUE
      C
0093          CALL CLOSE (2)
      C
0094          IWW = IW
0095          KIT = IGG+IHH*2+5
0096          DO 70 KI=1,KIT
0097          IF(KI.EQ.1) TX=FAA
0099          IF(KI.EQ.2) TX=FBB
0101          IF(KI.EQ.3) TX=FCC
0103          IF(KI.EQ.4) TX=FDD
0105          IF(KI.GT.4.AND.KI.LE.(4+IGG)) TX=F4(KI-4)
0107          IF(KI.GT.(4+IGG).AND.KI.LE.(4+IGG+IHH)) TX=F23(KI-4-IGG)
0109          IF(KI.GT.(4+IGG+IHH).AND.KI.LE.(4+IGG+IHH*2)) TX=F25(KI-4
             1-IGG-IHH)
```

```
0111          IF(KI.NE.(IGG+IHH*2+5)) GO TO 50
0113          TX = TJ
0114          IW = ICOD
0115    50    KA = TX
0116          TRA = (TX-KA)*100.
0117          KB = TX/100.
0118          TRB = (KA/100.-KB)*6000.
0119          KC = TX/10000.
0120          IF(IW.EQ.3) TRC=(KB/100.-KC)*600000.
0122          IF(IW.LT.3) TRC=(KB/100.-KC)*360000.
0124          IF(IW.GT.1) TX=TRA+TRB+TRC+KC*360000.
0126          IF(IW.EQ.1) TX=TRA+TRB+TRC+KC*86400.
0128          IF(KI.EQ.1) FAAS=TX
0130          IF(KI.EQ.2) FBBS=TX
0132          IF(KI.EQ.3) FCCS=TX
0134          IF(KI.EQ.4) FDDS=TX
0136          IF(KI.GT.4.AND.KI.LE.(IGG+4)) F4S(KI-4)=TX
0138          IF(KI.GT.(4+IGG).AND.KI.LE.(4+IGG+IHH)) F23S(KI-4-IGG)=TX
0140          IF(KI.GT.(4+IGG+IHH).AND.KI.LE.(4+IGG+IHH*2)) F25S(KI-4-IGG
             1-IHH)=TX
0142          IF(KI.EQ.(5+IGG+IHH*2)) TJS=TX
0144    70    CONTINUE
0145          NIY = 0
0146          NIZ = 0
0147          MG = 0
0148    71    CONTINUE
0149          MG = MG+1
      C
0150          DO 51 JIM=1,7
0151          SR(JIM) = 0.
0152    51    SM(JIM) = 0.
0153          XR1 = 0.
0154          XM1 = 0.
0155          IFLAG = 0
0156          ICK = 0
0157          F4SXR = 0.
0158          F4SXM = 0.
      C
0159          DO 20 NI=1,IGG
0160          IF(ICK.EQ.1) GO TO 18
0162          NIX = NI+NIY
0163          JR2 = I2(NIX)
0164          IF(JR2.EQ.999) GO TO 57
0166          IF(JR2.LT.100) GO TO 29
0168          DO 22 MI=1,64
0169          IF(JR2.EQ.ASSC(MI)) GO TO 23
0171    22    CONTINUE
0172          TYPE 131
0173    23    JR2 = ASSD(MI)
0174    29    CONTINUE
0175          DO 44 IIK=1,13
0176          IF(JR2.EQ.RES(IIK)) GO TO 45
0178    44    CONTINUE
0179          TYPE 131
0180    45    XR2 = DEG(IIK)
0181          DO 31 JAL=1,7
0182          SR(JAL) = SR(JAL) + (XR2**JAL+XR1**JAL)*(F4S(NI)-F4SXR)
```

```
0183    31    CONTINUE
0184          F4SXR = F4S(NI)
0185          XR1 = XR2
      C
0186    57    JM2 = I3(NIX)
0187          IF(JM2.EQ.999) GO TO 18
0189          IF(JM2.LT.100) GO TO 24
0191          DO 25 IONK=1,64
0192          IF(JM2.EQ.ASSC(IONK)) GO TO 26
0194    25    CONTINUE
0195          TYPE 131
0196    26    JM2 = ASSD(IONK)
0197    24    CONTINUE
0198          DO 46 IAK=1,13
0199          IF(JM2.EQ.RES(IAK)) GO TO 47
0201    46    CONTINUE
0202          TYPE 131
0203    47    XM2 = DEG(IAK)
0204          DO 30 JAL=1,7
0205    30    SM(JAL) = SM(JAL) + (XM2**JAL+XM1**JAL)*(F4S(NI)-F4SXM)
0206          F4SXM = F4S(NI)
0207          XM1 = XM2
      C
0208    18    IF((NI+NIY).EQ.IGG) GO TO 40
0210    15    IF(I1(NI+NIY+1).NE.1) GO TO 21
0212          IFLAG = 1
0213          NIY = NIY + NI
0214          GO TO 40
0215    21    IF((F4S(NI+1)-FCCS).GT.TJS) ICK = 1
0217    20    CONTINUE
0218    40    CONTINUE
0219          DO 41 JON=1,7
0220          SR(JON) = SR(JON)/(2*(F4S(NI)-FCCS)*4**JON*.01)
0221    41    SM(JON) = SM(JON)/(2*(F4S(NI)-FCCS)*4**JON*.01)
0222          IF(IDATA.NE.1) GO TO 11
0224          IF(NIZ.NE.0) GO TO 11
0226          NIZ = NIZ+1
0227          TYPE 400,IAAA,AAA
0228          TYPE 401,IB,CC
0229          TYPE 402,IFN,FN
0230          TYPE 403,ID,EE
0231          TYPE 404,IH,II
0232          TYPE 405,FF1,FF2,FF3,FF4,FF5,FF6,FF7
0233          TYPE 406,GG1,GG2,GG3,GG4
0234          TYPE 407,FX,IN
0235          TYPE 408,FJ,FK
0236          TYPE 409,FL,IM
0237          TYPE 410,IO,FP
0238          TYPE 411,IQ,FR
0239          TYPE 412,IS,IT
0240          TYPE 413,IU,FV
0241          TYPE 414,IW,PPP
0242          TYPE 415,FAA,FBB,FCC,FDD
0243          TYPE 416,EEE
0244          TYPE 417,IFF
0245          TYPE 418,IGG
0246          TYPE 125
```

```
RT-11 FORTRAN IV          V01B-08     MON 28-AUG-78 01:17:38        PAGE 005

0247          TYPE 126, (I1(I),I2(I),I3(I),F4(I),F5(I),I6(I),I7(I),I8(I),
             1I9(I),F10(I),F11(I), I=1,NI)
0248          IF(NI.EQ.IGG) GO TO 12
0250          TYPE 140, (I1(I),I2(I),I3(I),F10(I),F11(I), I=(NI+1),IGG)
0251          TYPE 129, IHH
0252    12    IF(IHH) 11,11,10
0253    10    TYPE 127
0254          TYPE 128, (I20(J),I21(J),I22(J),F23(J),F24(J),F25(J),
             1F26(J), J=1,IHH)
0255    11    CONTINUE
0256          TYPE 204, IFF(MG)
0257          TYPE 205, (JON,SR(JON),JON,SM(JON), JON=1,7)
0258          IF(IFLAG.EQ.1) GO TO 71
0260     90   CONTINUE
0261          IF (NN.LT.NON) GO TO 87
0263          TYPE 216
      C
0264    100   FORMAT(/'$DIVE FILE : ')
0265    101   FORMAT(Q,80A1)
0266    115   FORMAT(3I4,2F9.2,4I5,2F6.2)
0267    116   FORMAT(3I4,4F10.2)
0268    125   FORMAT(' EVAL','  D(R), D(M),   TIME,   DEPTH, TAPE: REST,',
             1' TAPE: MOVE, WD(R), WD(M)',/'  NO',44X,'A    B     C',/)
0269    126   FORMAT(1X,I3,3X,I3,3X,I3,F11.2,F8.1,2I7,2I5,2F6.2,/)
0270    127   FORMAT(//' D.S. NO, TYPE, SEVERITY, T(START),   P(START),',
             1'   T(END),    P(END)',/)
0271    128   FORMAT(I5,I7,I9,2F12.2,2F11.2,/)
0272    129   FORMAT(' NO OF INCIDENCES OF D.S.:',I6,/)
0273    200   FORMAT(/'$TYPE 1 FOR DATA LISTING : ')
0274    201   FORMAT(I2)
0275    202   FORMAT(/'$TYPE CODE, TIME RANGE : ')
0276    204   FORMAT(///,17X,' MONITOR NO.',I5,/)
0277    205   FORMAT(/' S(R,',I1,') =',F7.2,21X,'S(M,',I1,') =',F7.2)
0278    203   FORMAT(I6,F12.2)
0279     131  FORMAT(///20X,'INVALID DATA',///)
0280    140   FORMAT(1X,I3,3X,I3,3X,I3,43X,2F6.2,/)
0281    210   FORMAT (/'$NUMBER OF FILE FILES ? ')
0282    211   FORMAT (I4)
0283    212   FORMAT (////////////////////'$NEXT FILE ? ')
0284    213   FORMAT (//'$FILE FILE : ')
0285    214   FORMAT(/'**********************************')
0286    215   FORMAT(/' DIVE FILE : ',6A1)
0287    216   FORMAT (/////////)
0288    217   FORMAT (//'!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!')
0289    300   FORMAT(I5,7,5A1)
0290    301   FORMAT(I6,/,45A1)
0291    302   FORMAT(7(5A1,1X))
0292    303   FORMAT(4(5A1,1X))
0293    304   FORMAT(F7.2,3I3)
0294    305   FORMAT(2F6.2)
0295    306   FORMAT(F6.2,I4)
0296    307   FORMAT(I4,F6.1)
0297    308   FORMAT(2I6)
0298    309   FORMAT(I4,F10.2)
0299    310   FORMAT(4F10.2)
0300    311   FORMAT(71A1)
0301    312   FORMAT(4I6)
```

```
0302    313  FORMAT(I6)
0303    400  FORMAT(/' FILE:.....  ','#',I6,',  ',5A1/)
0304    401  FORMAT(' DIVE SERIES: ',IX,'#',I6,',  ',45A1,/)
0305    402  FORMAT(' PROFILE:.... ','#',I6,',  ',45A1,/)
0306    403  FORMAT(' DIVE:.....  ','#',I6,',  ',45A1,/)
0307    404  FORMAT(' DIVER:.....  ','#',I6,',  ',45A1,/)
0308    405  FORMAT(' ASSOCIATED DUDB FILES: ',7(IX,5A1))
0309    406  FORMAT(' AUXILLIARY FILES: ',5X,4(IX,5A1)/)
0310    407  FORMAT(' TIME OF DAY:.....',F7.2,5X,
            1'DATE OF DIVE:.... ',3(IX,I2))
0311    408  FORMAT(' WEIGHT:..... ',F6.2,5X,
            1'HEIGHT:.....    ',F6.2)
0312    409  FORMAT(' FAT COMPOSITION:. ',F6.2,5X,
            1'TYPE OF DIVE:....',6X,I4)
0313    410  FORMAT(' ENVIRONMENT:.....   ',I4,5X,
            1'TEMPERATURE:.....',4X,F6.1)
0314    411  FORMAT(' TYPE OF WORK:....   ',I4,5X,
            1'QUANTITY OF WORK:',4X,F6.1)
0315    412  FORMA (' TAPE RECORDER NO: ',I6,5X,
            1'TAPE NO:.....',4X,I6)
0316    413  FORMAT(' DEPTH CODE:.....   ',I4,5X,
            1'BOTTOM DEPTH:....',4X,F6.1)
0317    414  FORMAT(' TIME CODE:.....   ',I4,5X,
            1'TIME OF PROF ALT:',F10.2,/)
0318    415  FORMAT(' T(BEG):.....',F10.2,/' T(ARRIVAL):...',F10.2,
            1/' T(BEG DECOMP):',F10.2/' T(END DECOMP):',F10.2,/)
0319    416  FORMAT(IX,71A1,/)
0320    417  FORMAT(' MONITOR NOS:',4(IX,I6),/)
0321    418  FORMAT(' TOTAL NO OF EVAL:',I6,/)
0322         END
```